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COMMENTS:

Serial No. 10/591,426

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Transmitted by: Patricia A. Mack **Time:** 4:58 PM.

Patent
Docket No.: 050096PCTUS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Art Unit: 1796

Examiner: Michael Bernshteyn

In re Application of:
Krzysztof Matyjaszewski et al.

Serial No.: 10/591,426

Filing Date: June 13, 2007

ATOM TRANSFER RADICAL POLYMERIZATION PROCESS

Interview Summary

June 15, 2010

VIA FASCIMILE

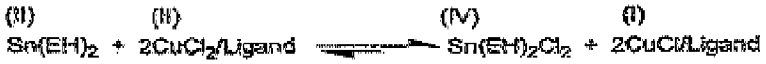
Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Examiner Bernshteyn:

Applicants wish to thank Examiner Bernshteyn for the courtesy of a telephone interview conducted on June 15, 2010. Participating on behalf of the Applicants were the undersigned representative and Joseph Kent (Reg. No. 54,216). During the interview, the participants discussed US Patent Publication No. US 2002/0128405 to Matyjaszewski and Hong (Reference 1). Applicants also note that International Publication No. WO 2007/059350 to Matyjaszewski and Spanswick is not prior art because its November 17, 2005 priority date is more than one year after the March 5, 2004 priority date of the subject application. In response to the telephone interview,

Applicants submit the following remarks and proposed claim amendments, in which claims 39-51 and 62 are canceled.

The proposed amendment to claim 1 recites a polymerization process comprising, in part, "wherein an oxidized reduction product does not participate as an initiator or catalyst in control of the polymerization process." The proposed amendment to claim 52 recites a polymerization process comprising, in part, "an oxidized reduction product that does not participate as an initiator or catalyst in control of the polymerization process." As shown in Scheme 3 of the subject application, $Sn(EH)_2$ reduces the inactive Cu(II) catalyst to an active Cu(I) catalyst and forms an oxidized reduction product (in this case $Sn(EH)_2Cl_2$) that does not participate as an initiator or catalyst in control of the polymerization process.



Scheme 3. Reduction of $Cu^{(II)}$ to $Cu^{(I)}$ by $tin^{(II)}$ 2-ethilhexanoate.

In contrast, Reference 1 teaches that free radicals or copper in the zero oxidation state can be used as a reducing agent. See Reference 1, paragraph [0052]. When a free radical is used as a reducing agent, the oxidized reduction product is an alkyl halide which can participate as an initiator in the polymerization process. When a transition metal in the zero oxidation state, such as Cu(0), is used as a reducing agent, the oxidized reduction product is Cu(I) which can participate as an catalyst in the polymerization process. These oxidized reduction products can contribute to side reactions and the formation of by-products during the polymerization process. The proposed amendments to claims 1 and 52 distinguish the claimed subject matter from Reference 1.

Claim 1 encompasses a direct process to reduce the transition metal catalyst from the oxidized, inactive state to the reduced, active state. In claim 1, the reducing agent reacts with the transition metal catalyst in the oxidized, inactive state to form the transition metal catalyst in the reduced, active state. Further, the molar ratio of the transition metal catalyst to the atom transfer radical polymerization is less than 0.05.

Claim 52 encompasses a direct and indirect process to reduce the transition metal catalyst from the oxidized, inactive state to the reduced, active state. In the direct process, the reducing agent reacts with the transition metal catalyst. This is similar to the process recited in claim 1. In the indirect process, the reducing agent reacts with a compound comprising a radically transferable atom or group to form an oxidized reduction product and a free radical. The free radical reacts with and reduces the transition metal catalyst in the oxidized, inactive state to form the transition metal catalyst in the reduced, active state. Further, the molar ratio of the transition metal catalyst to the atom transfer radical polymerization is less than 0.25.

If the examiner has any concerns regarding Applicants' present response, the Examiner is invited to contact Applicants' undersigned representative at the telephone number listed below so that those concerns may be expeditiously addressed.

Respectfully submitted,

Date 06-15-2010

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PROPOSED AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A polymerization process, comprising:

polymerizing free radically (co)polymerizable monomers in the presence of a reducing agent and a polymerization medium initially comprising:

at least one transition metal catalyst; and

an atom transfer radical polymerization initiator; and

wherein the molar ratio of the transition metal catalyst to the atom transfer radical polymerization initiator is less than 0.05,

wherein the reducing agent is capable of reducing the at least one transition metal catalyst from an oxidized, inactive state to a reduced, active state, and

wherein ~~the~~ an oxidized reduction product does not participate as an initiator or catalyst in control of the polymerization process.

2. (Previously Presented) The polymerization process of claim 1, wherein the transition metal catalyst is in an oxidized state, and the polymerization process further comprises reacting the reducing agent with at least one of the transition metal catalyst in an oxidized state and a compound comprising a radically transferable atom or group to form a compound that does not participate in control of the polymerization process.

3. (Canceled)

4. (Canceled)

5. (Original) The polymerization process of claim 1, wherein the concentration of transition metal catalyst in the polymerization medium is less than 1000 ppm.

6. (Original) The polymerization process of claim 1, wherein the concentration of transition metal catalyst in the polymerization medium is less than 100 ppm.

7. (Original) The polymerization process of claim 1, wherein the concentration of transition metal catalyst in the polymerization medium is less than 10 ppm.

8. (Original) The polymerization process of claim 1, wherein the polymerization medium further comprises a suspending medium.

9. (Original) The polymerization process of claim 1, wherein the reducing agent is an inorganic compound.

10. (Original) The polymerization process of claim 9, wherein the reducing agent is at least one of a transition metal compound, a sulfur compound of a low oxidation level, sodium hydrogen sulfite, an inorganic salt comprising a metal ion, hydrazine hydrate, and derivatives of such inorganic compounds.

11. (Original) The polymerization process of claim 10, wherein the metal ion is at least one of Sn^{2+}, Fe^{2+}, Cr^{3+}, Al^{3+}, Ti^{3+} and Ti^{4+}.

12. (Original) The polymerization process of claim 11, wherein the metal ion is at least one of Sn^{2+}, Fe^{2+}, Cr^{3+} and Ti^{3+}.

13. (Original) The polymerization process of claim 1, wherein the reducing agent is an organic compound.

14. (Previously Presented) The polymerization process of claim 13, wherein the reducing agent is at least one of alkylthiols, mercaptoethanol or carbonyl compounds that can be easily enolized, ascorbic acid, acetyl acetonate, camphorsulfonic acid, hydroxy acetone, reducing sugars, monosaccharides, glucose, aldehydes, and derivatives of such organic compounds.

15. (Original) The polymerization process of claim 1, wherein the atom transfer radical polymerization initiator comprises at least two radically transferable atoms or groups.

16. (Original) The polymerization process of claim 1, wherein the atom transfer radical polymerization initiator comprises a radically transferable atom or group attached to a polymer or a solid.

17. (Original) The polymerization process of claim 1, wherein the polymerization medium further comprises a solvent or suspending medium.

18. (Original) The polymerization process of claim 17, wherein the polymerization process is one of an emulsion polymerization, a mini-emulsion polymerization, microemulsion process, a reverse emulsion polymerization, and a suspension polymerization.

19. (Original) The polymerization process of claim 1, wherein the polymerization process further comprises a suspending medium, a surfactant, and a monomer phase comprising at least a portion of the radically polymerizable monomers.

20. (Original) The polymerization process of claim 19, wherein the reducing agent is capable of reacting with dissolved oxygen or react with a transitional complex that was oxidized by oxygen.

21. (Original) The polymerization process of claim 19, wherein the suspending medium is an inorganic liquid.

22. (Original) The polymerization process of claim 21, wherein the suspending medium is water.

23. (Original) The polymerization process of claim 22, wherein the reducing agent is water soluble.

24. (Original) The polymerization process of claim 1, wherein the reducing agent is at least partially soluble in the polymerization medium.

25. (Original) The polymerization process of claim 1, wherein the transition metal catalyst participates in a redox reaction between a higher oxidation state and a lower oxidation state.

26. (Original) The polymerization process of claim 25, wherein the molar ratio of reducing agent to transition metal catalyst in the higher oxidation state is 1 or less.

27. (Original) The polymerization process of claim 1, wherein the atom transfer radical polymerization initiator is at least one of an alkyl halide and a substituted ester.

28. (Original) The polymerization process of claim 19, wherein the polymerization medium further comprises a base.

29. (Original) The polymerization process of claim 1, wherein the atom transfer radical polymerization initiator comprises a radically transferable atom or group attached to a substrate.

30. (Original) The polymerization process of claim 1, wherein the reducing agent is capable of reacting with dissolved oxygen or react with a transitional complex that was oxidized by oxygen.

31. (Original) The polymerization process of claim 1, wherein the polymerization medium further comprises a base.

32. (Original) The polymerization process of claim 1, wherein the polymerization medium comprises two reducing agents.

33. (Original) The polymerization process of claim 32, wherein the rate of reduction of the two reducing agents is different.

34. (Original) The polymerization process of claim 18, wherein the atom transfer radical polymerization initiator comprises at least two radically transferable atoms or groups.

35. (Original) The polymerization process of claim 19, wherein the reducing agent is soluble in at least one of the suspending phase and the monomer phase.

36. (Original) The polymerization process of claim 1, wherein the molar ratio of reducing agent to transition metal catalyst in the higher oxidation state is more than 1.

37. (Original) The polymerization process of claim 17, wherein the polymerization medium comprises two reducing agents.

38. (Original) The polymerization process of claim 37, wherein the rate of reduction of the two reducing agents is different.

39-51. (Canceled)

52. (Currently Amended) A polymerization process, comprising:

polymerizing free radically (co)polymerizable monomers in the presence a polymerization medium initially comprising:

at least one transition metal catalyst;

a reducing agent, and

an atom transfer radical polymerization initiator;

wherein the molar ratio of the transition metal catalyst to the atom transfer radical polymerization initiator is less than 0.25 and the reducing agent reacts with at least one of the transition metal catalyst and a compound comprising a radically transferable atom or group to form ~~a compound~~ an oxidized reduction product that does not participate as an initiator or catalyst in control of the polymerization process.

53 - 56. (Canceled)

57. (Original) The polymerization process of claim 28, wherein the base is a ligand.

58. (Original) The polymerization process of claim 31, wherein the base is a ligand.

59. (Previously Presented) The polymerization process of claim 52, wherein the reducing agent is one of an inorganic or an organic reducing agent.

60. (Previously Presented) The polymerization process of claim 59, wherein the organic reducing agent is one of at least one of alkylthiols, mercaptoethanol or carbonyl compounds that can be easily enolized, ascorbic acid, acetyl acetonate, camphorsulfonic acid, hydroxy acetone, reducing sugars, monosaccharides, glucose, aldehydes, or derivates of such organic compounds.

61. (Previously Presented) The polymerization process of claim 60, wherein the organic reducing agent is ascorbic acid or a derivative of ascorbic acid.

62. (Canceled)